



# UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE  
United States Patent and Trademark Office  
Address: COMMISSIONER OF PATENTS AND TRADEMARKS  
Washington, D.C. 20231  
www.uspto.gov

| APPLICATION NO. | FILING DATE | FIRST NAMED INVENTOR | ATTORNEY DOCKET NO. | CONFIRMATION NO. |
|-----------------|-------------|----------------------|---------------------|------------------|
| 09/864,714      | 05/23/2001  | Ajit P. Paranjpe     | 021208.0238         | 1724             |

7590 01/15/2003  
Robert W. Holland  
Baker Botts LLP  
Suite 600  
2001 Ross Avenue  
Dallas, TX 75201-2980

EXAMINER

RAO, SHRINIVAS H

| ART UNIT | PAPER NUMBER |
|----------|--------------|
|----------|--------------|

2814

DATE MAILED: 01/15/2003

Please find below and/or attached an Office communication concerning this application or proceeding.

**Office Action Summary**

Application No.

09/864,714

Applicant(s)

PARANJPE ET AL.

Examiner

Steven H. Rao

Art Unit

2814

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

**Period for Reply**

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

**Status**

- 1) ☒ Responsive to communication(s) filed on 24 October 2001.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

**Disposition of Claims**

- 4) ☒ Claim(s) 1-32 is/are pending in the application.
- 4a) Of the above claim(s) 27-32 is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☐ Claim(s) 1-26 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

**Application Papers**

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 23 May 2001 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.
- Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) ☐ The proposed drawing correction filed on \_\_\_\_\_ is: a) ☐ approved b) ☐ disapproved by the Examiner.
- If approved, corrected drawings are required in reply to this Office action.
- 12) ☐ The oath or declaration is objected to by the Examiner.

**Priority under 35 U.S.C. §§ 119 and 120**

- 13) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some \* c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
  2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
  3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- \* See the attached detailed Office action for a list of the certified copies not received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).
- a) ☐ The translation of the foreign language provisional application has been received.
- 15) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

**Attachment(s)**

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s) \_\_\_\_\_
- 4) ☐ Interview Summary (PTO-413) Paper No(s). \_\_\_\_\_
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: \_\_\_\_\_

## DETAILED ACTION

### ***Priority***

The application as currently filed does not claim priority from any previously filed Patent Application. Therefore the earliest available filling date is the U.S. filling date namely May 23, 2001.

### ***Preliminary Amendment Status***

Acknowledgment is made of entry of preliminary amendment filed June 13, 2001 which has been entered on September 30, 2002.

### ***Election/Restrictions***

Restriction to one of the following inventions is required under 35 U.S.C. 121:

- I. Claims 1-26 are, drawn to a method of fabricating a conformal film, classified in class 438, subclass 253.
- II. Claims 27-32 are, drawn to a microstructure having a  $\text{AlO}_x$ , classified in class 257, subclass 302.

Inventions Group I and II are related as process of making and product made. The inventions are distinct if either or both of the following can be shown: (1) that the process as claimed can be used to make other and materially different product or (2) that the product as claimed can be made by another and materially different process (MPEP § 806.05(f)). In the instant case that the process as claimed can be used to make other and materially different product a film that is different from  $\text{AlO}_x$  eg.  $\text{Ta}_2\text{O}_5$

Art Unit: 2814

and also the product as claimed can be made by another and materially different process namely instead of using the plasma annealing cycle a RTA cycle can be used.

Because these inventions are distinct for the reasons given above and have acquired a separate status in the art as shown by their different classification, restriction for examination purposes as indicated is proper.

During a telephone conversation with Ms. Paula Heymen ( R.No. 48,363) @ (512) -322-2581 on December 18, 2002 a provisional election was made without traverse to prosecute the invention of Group I, claims 1-26. Affirmation of this election must be made by applicant in replying to this Office action.

Claim 27-32 are withdrawn from further consideration by the examiner, 37 CFR 1.142(b), as being drawn to a non-elected invention.

Applicant is reminded that upon the cancellation of claims to a non-elected invention, the inventorship must be amended in compliance with 37 CFR 1.48(b) if one or more of the currently named inventors is no longer an inventor of at least one claim remaining in the application. Any amendment of inventorship must be accompanied by a request under 37 CFR 1.48(b) and by the fee required under 37 CFR 1.17(i).

#### ***Drawings***

The drawings filed on May 23, 2001 have been accepted by the draftsperson.

#### ***Claim Rejections - 35 USC § 112***

Art Unit: 2814

Claim 3 is rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

In claim 3 the phrase "wherein the frequency of the anneals controls the intrinsic film stress from tensile to compressive " renders the claim indefinite because the term "controls the intrinsic film stress from tensile to compressive " is not clear what applicants' intend to include/exclude by the recitation.

Further, the specification, the prior art or knowledge of one of ordinary skill in the art does not clarify what applicants' intend to include/exclude by the above recitation.

Similarly in claim 6, it is not clear what applicants' intend to include/exclude by their recitation, "wherein annealing further comprises plasma annealing in a reactive ambient every 25 to 50 Å of deposition. "

Further, the specification, the prior art or knowledge of one of ordinary skill in the art does not clarify what applicants' intend to include/exclude by the above recitation.

Appropriate correction is required.

### ***Claim Rejections - 35 USC § 102***

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

Art Unit: 2814

A person shall be entitled to a patent unless –

(e) the invention was described in a patent granted on an application for patent by another filed in the United States before the invention thereof by the applicant for patent, or on an international application by another who has fulfilled the requirements of paragraphs (1), (2), and (4) of section 371(c) of this title before the invention thereof by the applicant for patent.

The changes made to 35 U.S.C. 102(e) by the American Inventors Protection Act of 1999 (AIPA) do not apply to the examination of this application as the application being examined was not (1) filed on or after November 29, 2000, or (2) voluntarily published under 35 U.S.C. 122(b). Therefore, this application is examined under 35 U.S.C. 102 (e) prior to the amendment by the AIPA (pre-AIPA 35 U.S.C. 102(e)).

Claims 1 and 10-12 are rejected under 35 U.S.C. 102(e) as being anticipated by Kim (U.S. Patent No. 6,335,240, herein after Kim).

With respect to claim 1, Kim describes a method of fabricating a conformal film on a substrate, the method comprising the steps of : depositing a film of predetermined thickness on the substrate by performing a predetermined number of atomic layer deposition cycles in a processing chamber, (Kim fig. 1 # 400, col. 4 lines 25-29) each atomic layer deposition cycle comprising : dosing the substrate with a reactant to deposit an atomic layer deposition film (Kim col. 4 lines 30-34) and annealing the substrate after a predetermined number of atomic layer deposition cycles. (Kim col. 6 lines 38-40).

With respect to claim 10, wherein the atomic layer deposition cycle deposits a film having a thickness of approximately  $0.8 \text{ \AA}$ . (Kim col. 5 line 49 ).

With respect to claim 11, wherein the precursor comprises a trimethyl aluminum, the reactant comprises water and annealing further comprises annealing in a reactive

Art Unit: 2814

ambient comprising oxygen. (Kim col. 5 line 54, col. 5 lines 55-56 and Kim col. 3 lines 13-16).

With respect to claim 12, wherein the annealing comprises a rapid thermal anneal. (Kim col. 5 lines 19-20).

***Claim Rejections - 35 USC § 103***

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

Claims 2-9 and 13-14 and 16-26 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kim (U.S. Patent No. 6,335,240, herein after Kim) as applied to calim1 above and further in view of Seutter et al. (U.S. Patent Publication No. 2002/0106846 herein after Seutter).

With respect to claim 2, wherein annealing further comprises plasma annealing the substrate.

Kim describes annealing the substrate without specifying the particular annealing method used.

Seutter, a patent from the same filed of endeavor, describes in paragraph 0058 page 5 lines 6 to 16 plasma annealing method to reduce the nitrogen content in the neighboring layers which in turn reduces the resistivity of the device, for densifying the dielectric layer and thus making a better device.

Therefore it would have been obvious to one of ordinary skill in the art at the time of the invention to use Kloster's annealing by plasma treatment instead of Kim's unspecified annealing in Kim's method to reduce the nitrogen content in the neighboring layers which in turn reduces the resistivity of the device, densifying the dielectric layer and thus making a better device. ( Seutter para 58, page 5).

With respect to claim 3, to the extent understood, wherein annealing the substrate further comprises performing plural plasma anneals, wherein the frequency of the anneals controls the intrinsic film stress from tensile to compressive. (Kim col. 4 lines 32-35).

With respect to claim 4, wherein annealing the substrate further comprises performing plural plasma anneals, wherein the frequency of the anneals is determined to achieve a desired breakdown field strength.(Kim col. 4 lines 19-24).

With respect to claim 5, wherein the annealing further comprises plasma annealing in a reactive ambient. (Seutter para 58 lines 4-5).

With respect to claim 6, to the extent understood, "wherein annealing further comprises plasma annealing in a reactive ambient every 25 to 50 Å<sup>0</sup> of deposition." ( Seutter para 60, page 5).

With respect to claim 7, further comprising heating the substrate to a temperature sufficiently low so that the mono layer of precursor adsorbed on the substrate is not thermally dissociated. ( Seutter para 61 last 4 lines).



With respect to claim 8, wherein the precursor comprises trimethyl aluminum and the substrate is heated to a temperature within the range of between 60 degrees Celsius and 350 degrees Celsius. (Kim col. 5 lines 54-64).

With respect to claim 9, wherein substrate temperature is approximately 150 to 200 degrees Celsius. (Kim col. 5 lines 59-60).

With respect to claim 13, wherein the annealing comprises an in-situ plasma anneal. (Seutter para 0061 plasma within chamber i.e. in-situ).

With respect to claim 14, wherein the plasma anneal comprises heating the substrate with an RF source in an Ar/O<sub>2</sub> ambient. (Seutter para 0058 page 5- Ar ambient, RF -source well known in the art).

With respect to claim 16, wherein the dosing the substrate with a precursor further comprises flowing the precursor from a first zone of a multi-zone shower head and dosing the substrate with a reactant further comprises flowing the reactant from a second zone of a multi-zone showerhead. (Seutter paras 24 and 25).

With respect to claim 17, a method for fabricating a thin AlO<sub>x</sub> film on a substrate with a precursor and atomic layer deposition, the method comprising : heating the substrate to a temperature so that precursor adsorbed on the substrate is not thermally dissociated ( Seutter para 61 last 4 lines) and performing plural atomic layer deposition cycles, each cycle comprising deposition of AlO<sub>x</sub> by reacting a mono layer of precursor on the substrate with a reactant (Kim col. 4 lines 32-35) ; and annealing the AlO<sub>x</sub> film in a reactive ambient at one or more predetermined film thickness. (Seutter para 60, page 5).

Art Unit: 2814

With respect to claim 18, wherein the precursor comprises trimethyl aluminum.( Kim col. 5 lines 54-64).

With respect to claim 19, wherein the substrate temperature comprises approximatley 200 degree Celsius or less. (Kim col. 5 lines 54-64).

With respect to claim 20, wherein the reactant comprises water.( Kim col. 5 lines 55-56).

With respect to claim 21, wherein the precursor flows from a first zone of a multi zone showerhead and the reactants flows a second zone of the multi-zone showerhead. (Seutter paras 24 and 25).

With respect to claim 22, wherein annealing further comprises annealing the  $AlO_x$  approximately every 25 to 50  $\text{\AA}$  of thickness. (Seutter para 60, page 5)

With respect to claim 23, wherein annealing comprises in-situ annealing in a reactive ambient. (Seutter para 0061 plasma within chamber i.e. in-situ).

With respect to claim 24, wherein the reactive ambient comprises Ar/oxygen that oxidizes impurities associated with the  $AlO_x$  film. .( Seutter para 0058 page 5- Ar).

With respect to claim 25, wherein the film comprises a gap layer for a thin film head.(Kim figs. 3,4).

With respect to claim 26, wherein the film comprises a tunnel barrier in a magnetic tunnel junction. (Seuter para 0005).

B. Claim 15 is rejected under 35 U.S.C. 103(a) as being unpatentable over Kim ( U.S. Patent No. 6,335,240, herein after Kim) and Sutter et al. (U.S. Patent Publication

No. 2002/0106846 herein after Seutter) as applied to the claims above and further in view of Yamada et al. ( U.S. Patent no. 5,616,177 herein after Yamada).

With respect to claim 15, further comprising maintaining a 50/500 dose to adsorption ratio.

Kim and Seutter describe a film, but do not describe a 50/500 dose to adsorption ratio.

However, Yamada a patent from the same filed of endeavor, describes in col.5 lines 29-37 dose to concentration (adsorption) ratio of between 2:1 to 8:1 to produce a semiconductor having excellent characteristics, a low threshold voltage and a low operating voltage.

Therefore it would have been obvious to one of ordinary skill in the art at the time of the invention to include Yamada's dose to adsorption ratio in Kim and Suetter's method to produce a semiconductor having excellent characteristics, a low threshold voltage and a low operating voltage. (Yamada col. 2 lines 28-40).

Further it would have been obvious to one of ordinary skill in the art at the time of the invention to use a 50/500 i.e. 1:10/ 10 :1 ratio without a showing of criticality or unexpected results because it was previously done by Yamada between 2:1 to 8:1.

Any inquiry concerning this communication or earlier communication from the examiner should be directed to Steven H. Rao whose telephone number is (703) 306-5584. The examiner can normally be reached on Monday- Friday from approximately 7:00 a.m. to 5:00 p.m.

Art Unit: 2814

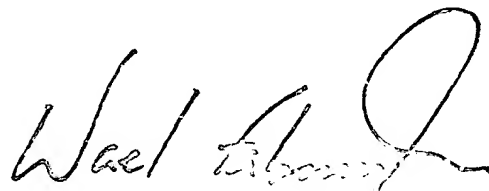
Any inquiry of a general nature or relating to the status of this application should be directed to the Group receptionist whose telephone number is (703) 308-0956. The Group facsimile number is (703) 308-7724.



Steven H. Rao

Patent Examiner

December 19, 2002.



SUPERVISORY PATENT EXAMINER  
TECHNOLOGY CENTER 2000